ICESat Science Investigator-Led Processing System

MOWG II

David Hancock

Sept 15-16, 1999

At GSFC

ICESAT/GLAS
SCIENCE SOFTWARE DEVELOPMENT

KEY PERSONNEL

Dr. Bob Schutz, GLAS Science Team Leader

Dr. Jay Zwally, ICESat Project Scientist, GLAS Team Member

Mr. David Hancock, Science Software Development Manager

Ms. Anita Brenner, Deputy Science Software Development Manager

Science Team/SCF Facilities

- **University of Texas - Dr. Bob Schutz, Science Team Leader**
- **Goddard Space Flight Center /Ice Sheet - Dr. Jay Zwally, GLAS Project Scientist**
- **Goddard Space Flight Center/Land - Dr. Jack Bufton**
- **Goddard Space Flight Center/Atmosphere - Dr. James Spinhirne**
- **Ohio State University - Dr. Robert Thomas**
- **University of Wisconsin - Dr. Charles Bentley**
- **Massachusetts Institute of Technology - Professor Thomas Herring**
- **University of California San Diego - Professor Jean-Bernard Minster**

I-SIPS BASIC DESCRIPTION

Performs:

- **The I-SIPS processing performs the following functions:**
  - **ingest input data**
  - **execute algorithms to create the GLAS level 1 and 2 data products**
  - **assess data product for quality and content, and produce metadata**
  - **create browse products**
  - **create processing reports/log**
  - **deliver data products to the NSIDC DAAC**
- **Perform reprocessing as required**
- **Create quick-look data for science team**
- **Receive Level 3 and 4 GLAS special data products produced by the science team**

I-SIPS PROCESSING BASIC REQUIREMENTS

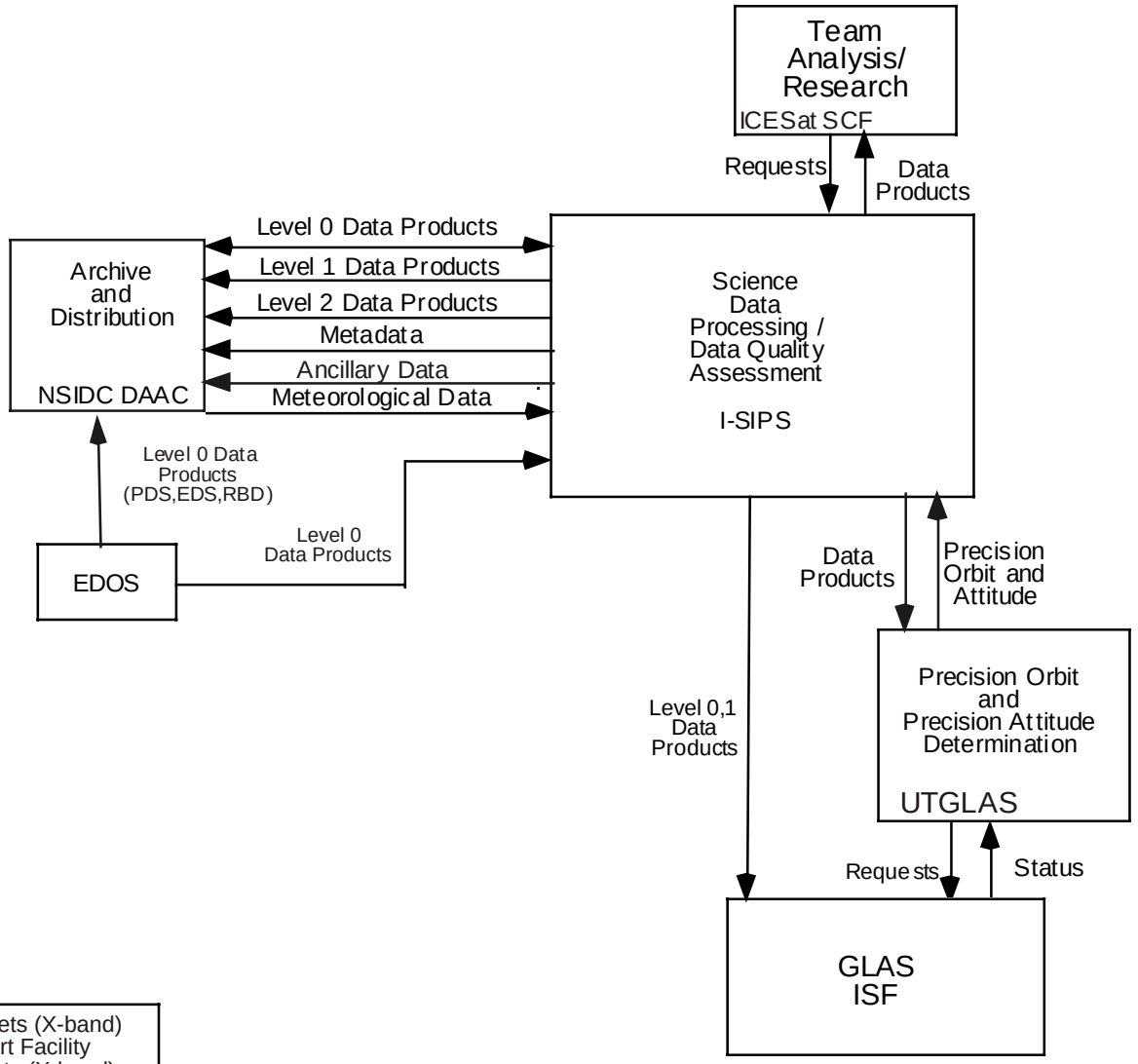
- **Process 24 hours of GLAS instrument data into standard data products within 4 hours of receipt of all required inputs**

- **Ability to distribute to the Science Team Level 1 and Level 2 data products within 24 hours of receipt of Level 0 data (uses predict ancillary data)**

- **Distribute fully processed Level 1 and Level 2 data products to NSIDC within 14 days of receipt of Level 0 data (after becoming operational and assuming proper ESDIS funding)**

- **Support reprocessing requirements without delaying regular processing assuming proper funding**

I-SIPS Interfaces



EDS	Expedited Data Sets (X-band)
ISF	Instrument Support Facility
PDS	Prodution Data Sets (X-band)
RBD	Rate Buffered Data (S-band)

DOCUMENTS

http://glas.wff.nasa.gov

SDS Documents

Science Software Management Plan
Science Software Data Management Plan
Science Software Requirements Document

I-SIPS Documents

I-SIPS Software Architectural Design Document
I-SIPS Software Detailed Design Document
GLAS Level 0 Instrument Data Product Specification
GLAS Standard Data Products Specification
I-SIPS Software User's Guide/Operational Procedures Manual
I-SIPS Software Assurance and Test Procedures
I-SIPS Software Science Data User's Handbook

Operations

- **Autonomous Operation 7 days/week, 24 hours**
- **Normal Manned Operation is 5 days/week, 12 hours**
- **Available on-call.**
- **Initial calibration period TBD (as many as required)**

Software Maintenance

- **Science Team**
  - **Will make Science Algorithm written change Request**
  - **Modifications made to ATBDs as required**
  - **Will develop and test new Standard Science Processing Software**
  - **Will deliver the Standard Science Processing Software to I-SIPS**
- **I-SIPS**
  - **Will receive, install, and test new software**
  - **Will maintain history of software used in data product production**
  - **Will deliver new s/w package to NSIDC for archive**

Data Ingest

- **EDOS - Level 0 (PDS,EDS)**
- **Central SAFS- S-band**
- **NSIDC- Met Data**
- **NSIDC - Level 0 by request**
- **UTGLAS - POD/PAD (Orbit and attitude)**
- **ICESat SCF - QA, Special Products**
- **ISF- Command File**
- **WFF- QA**

Data Destination

- **NSIDC -Standard and Special data Products**
- **UTGLAS - GPS/SRS**
- **ICESat SCF -Standard Data Products,QA**
- **ISF- Level 0 and 1 products**
- **WFF-QA**

I-SIPS Input Data

Products		Source - Mbytes Transferred per Day				
File ID	File Name	EDOS	Utexas	WFF	NSIDC*	GLAS SCF
GLA00	GLAS PDS (Telemetry Data)	8679.0			1237.0	
GLA ANC 01	Meteorological Data File				81.6	
GLA ANC 08	Precision Orbit Data File		4.0			
GLA ANC 09	Precision Attitude Data File		4.0			
GLA SUP 11	Instrument Performance Trend Files			0.1		
n/a	Special Products /QA Data					7240.0
Totals (Mbytes)		8679.0	8.0	0.1	1318.6	7240.0
Total Gbytes per Day						**17.2**
n/a = not applicable						
* Transfer of GLA00 from NSIDC is a backup to EDOS						
Note: Official transfer bytes are maintained in latest Data Product Specifications or the Data Management Plan.						

I-SIPS Output Data
(1st Year)

Products		Destinations - Mbytes transferred per day			
File ID	File Name	SCF	Utexas	WFF	NSIDC *
GLA00	GLAS PDS (Telemetry Data)				1237.0
GLA01	Altimetry Data File	1680.0		840.0	1680.0
GLA02	Atmosphere Data File			1239.0	2478.0
GLA03	Engineering Data File			82.1	82.1
GLA04	SRS and GPS Data File		2420.0		2420.0
GLA05	Waveform-based Range Corrections File	840.0			840.0
GLA06	Elevation File	446.8			446.8
GLA07	Backscatter File	5516.0			5516.0
GLA08	Boundary Layer and Elevated Aerosol Layer Heights File	7.7			7.7
GLA09	Cloud Height for Multiple Layers File	76.7			76.7
GLA10	Aerosol Vertical Structure File	303.8			303.8
GLA11	Thin Cloud/Aerosol Optical Depth File	17.8			17.8
GLA12	Ice Sheet Products File	256.0			256.0
GLA13	Sea Ice Products File	361.4			361.4
GLA14	Land Products File	455.4			455.4
GLA15	Ocean Products File	245.6			245.6
GLA ANC 08	Precision Orbit Data File				4.0
GLA ANC 09	Precision Attitude Data File				4.0
n/a	Special Products/Browse/Metadata				7240.0
Totals (Mbytes)		10207.3	2420.0	2161.1	23672.4
Total Gbytes Per Day					**38.5**

n/a - not applicable

* Transfer of GLA00 to NSIDC is a backup to EDOS

Note: Official transfer bytes are maintained in latest Data Product Specifications or the Data Management Plan.

EDOS Interface requirements

- **Provided inputs to I-SIPS**

- **PDS - Nominal three hours after available pass, Req 24 hours**
- **EDS - Three hours after pass**
- **S-band - Half hour after pass via Central SAFS**
- **Quick-Look PDS -Three hour after pass**

ISF Interface Requirements

- **I-SIPS provided to ISF**

- **On request provide immediate access to PDS,EDS, and S-Band after receiving**
- **Provide summary data for trend analyses**
  - **ISF provided to I-SIPS**
- **Event History log**
- **S-band data from MOC as required**

UTGLAS Interface

- **Per PDS period I-SIPS provides GPS,SRS, and selected S/C data within two hours of receiving**
- **UTGLAS provides POD/PAD daily**
- **UTGLAS provides Predict orbit daily**

NSIDC Interface

- **Standard Products - I-SIPS provides14 days after receiving POD/PAD**
- **Level 0 - NSIDC provides on request**
- **Special Products - I-SIPS provided 4 days after receipt**
- **Reprocessed Data- I-SIPS provides after QA**

ICESat SCF Functions

- Receive standard data products from I-SIPS
- Distribute selected standard data products or subsets of the same to Science Team (ST)
- Provide ST with selective visualization and data selection capability
- Provide science analysis tools
- Provide product QA

Status

- I-SIPS S/W version 0 delivered 8/99
- I-SIPS and SCF H/W selected
- I-SIPS S/W version 1 in progress
- SCF S/W Development in Progress

Schedule

- I-SIPS S/W CDR - Nov 1999
- I-SIPS Version 1 S/W - July 2000
- I-SIPS Facility Space available - July 2000
- I-SIPS H/W Installation - August 2000
- I-SIPS ready to support S/C Testing - Dec 2000
- I-SIPS and SCF ready for launch - Mar 2001

I-SIPS Typical Day Main Events

- **Ingest 4 sets of PDS and S-Band**
- **Produce Level 1A Products for current data**
- **Ingest POD/PAD for day N**
- **Produce Level 1B & 2 products for day N**
- **Distribute created products to SCF**
- **Create HDF products**
- **Distribute QA'd products to NSIDC**
- **Reprocess data based on updates(POD/PAD or Algorithm**

Discussion Issues

- **S-Band Data- Size, Content, Processing (later format)**
- **HDF-EOS overhead on file sizes**
- **HDF-EOS toolkit availability for current OS**
- **SSR Dumps - During MOWG Uniform PDS time periods 0 to 6, etc was decided to be created from the non-uniform pass dumps.**
- **GPS reformatting- MOWG action is to investigate I-SIPS creating the archive GPS product in standard format. (MOC will receive rate buffered GPS quickly)**
- **MOC S-band database- MOWG description was**
  - **raw data for about 2 weeks on-line**
  - **Summary data for trend stays on-line**
  - **Output format? (Files can be made)**

GLAS Instrument Support Facility

MOWG 2

Peggy Jester

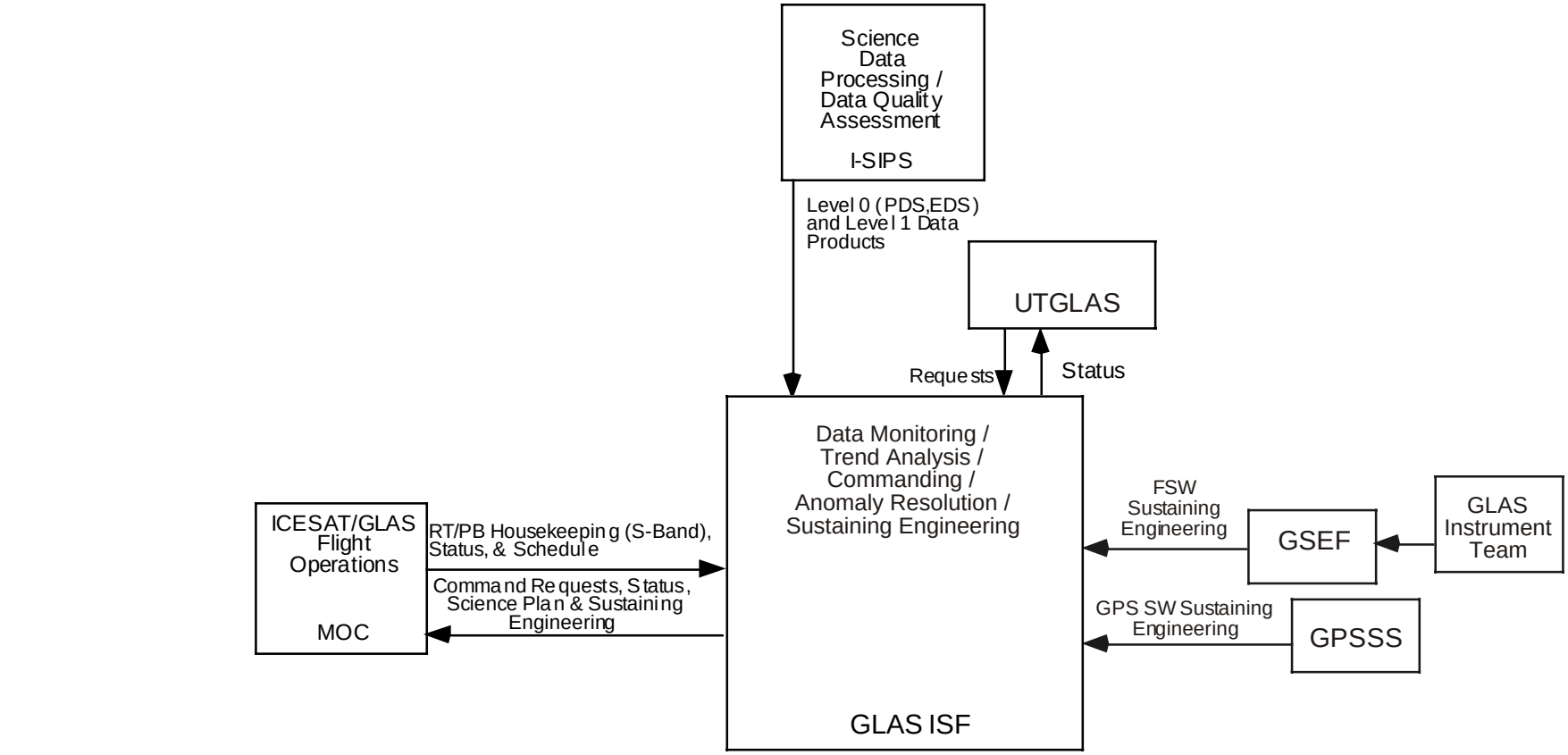
Raytheon ITSS

Sept 15-16, 1999

Instrument Support Facility Requirements

- Utilize MOC provided H/W and S/W to interface to the MOC for realtime display and command generation.
- Provide all additional H/W and S/W needed to Perform Instrument Performance Analysis
- IGS Mission Operations Requirements Documented in MORD
- Perform Planning and Scheduling for Routine and Special Events as defined by Science Team and Instrument Developer
- Perform Instrument Data Monitoring and Trend Analysis as Specified by Instrument Developer
- Provide Monitoring and Trend Analysis Data/Reports as Defined by Instrument Developer

Instrument Support Facility Interfaces



EPGS	EOS Polar Ground Station
FSW	Flight Software
ISF	Instrument Support Facility
GPS	Global Positioning System
GPSSS	GPS Sustaining Support
GSEF	GLAS Sustaining Engineering Facility
MOC	Mission Operations Center

Instrument Support Facility Requirements

Interface Requirements

MOC

- Provides S-Band Data -> Real-Time and Playback
- Receives Baseline Activity (Science) Plan and Command Requests
- Receives Command Uploads

EDOS

- Provides X-Band Data -> Upon Request

GLAS Science Team

- Provides Science Plans
- Receives Data and Reports

Instrument Support Facility Requirements

Interface Requirements cont'd

GLAS Instrument Team and GSEF

- Provides Flight Software Updates
- Provides Instrument Monitoring Requirements and Updates
- Receives Trend Analysis Data and Reports

GLAS SCF and I-SIPS

- Provides X-Band Data (PDS)

GPS Sustaining Support

- Provides GPS Software Updates
- Provides GPS Commands when Necessary

Instrument Support Facility
Inputs

Products		Source - Mbytes per Day	
File ID	File Name	MOC	WFF
GLA00 (GLA SUP 03)	GLAS Rate Buffered Data Files (GLAS RT and PB Housekeeping and Status Packets)	15.20	
GLA SUP 01	GLAS Baseline Activity Plan (Science Plan)		0.14
GLA SUP 02	Uplink and Downlink Schedules	0.14	
GLA SUP 05	Spacecraft Command Sequences	0.14	
GLA SUP 06	Predicted Events File	0.14	
GLA SUP 07	Spacecraft Flight Operations Schedule	0.14	
GLA SUP 08	Spacecraft Ephemeris Data Files	0.14	
GLA SUP 09	Telemetry Data Requests		0.14
GLA SUP 10	Status Reports		0.14
GLA SUP 11	Instrument Performance Trend Files		
GLA SUP 12	Event Log File	0.14	0.14
Totals		16.06	0.57
Total per Day (Mbytes)			**16.63**

Instrument Support Facility
Outputs

Products		Destination - Mbytes per Day			
File ID	File Name	MOC	WFF	GLAS Science Team	Glas Instrument Team
GLA SUP 01	GLAS Baseline Activity Plan	0.14			
GLA SUP 04	Instrument Command Blocks	0.14			
GLA SUP 08	Spacecraft Ephemeris Data Files			0.14	
GLA SUP 09	Telemetry Data Requests	0.14			
GLA SUP 10	Status Reports	0.14		0.14	0.14
GLA SUP 11	Instrument Performance Trend Files			0.14	0.14
GLA SUP 12	Event Log File		0.14		
GLA SUP 13	GLAS Command Requests	0.14			
Totals		0.72	0.14	0.43	0.29
Total per Day (Mbytes)					**1.57**

Instrument Support Facility Operations Concept

- Nominal 40 Hour Work Week
- IOT Members On-Call for Anomalies/Emergencies that may occur during off-shift hours
  -> Automatic Paging from ISF Computer
- Autonomous Monitoring, Trend Analysis
- OASIS for Interface to MOC for Data Collection, Monitoring, and Command Requests
- Provide Command Block Updates to MOC as Necessary.

Instrument Support Facility Operations Commanding

- Routine Activities
- Special, Known Activities, i.e., Laser and other redundant subsystem switching; DEM updates; targets of opportunity.
- Anomalous Events
- GPS

Instrument Support Facility Operations Commanding Concept

- Request Command Block to be Radiated
- Specify Execution Time / Constraints if any
- Supply Memory Uploads if Required
- Confirmation of Receipt and Radiation

Instrument Support Facility Operations Monitoring

Realtime Data :

- Temperature, Voltage, Current Displays
  -> Alarm Indicators, Red and Yellow Limits
- Alarm Pages
- Status Pages

Playback Data :

- Background Task
- Output Results to Logs / Reports

Instrument Support Facility Milestones

- OASIS and ITOC Training -> 9/21-23/99
- IST from Ball -> ?
- Other Equipment -> 4/00
- Ready to Support Instrument Testing -> 5/00
- Move into Building 22 -> 8/00

Splinter Meeting Topics

- Special Request X-Band Data Direct from EDOS or Via I-SIPS?
- Command Request Receipt and Radiation Verification - through OASIS? Radiation Log?
- Other?